

Stand-Scale Forest Models in B.C.: Which one works for you?

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Outline

- Overview of forest modelling
- Introduce forest models in BC
- Model selection criteria – which one is right for you?



What Are Forest Models?

- Simplified representations of reality
 - Explore how forests grow, change and respond to disturbances
- Not crystal balls
 - Don't predict the future
 - Explore possible futures based on assumptions



Why Use Forest Models?



- Forests are complex, diverse, and constantly changing
- Field experiments alone cannot answer all management questions
- Models allow
 - test scenarios
 - evaluate long-term outcomes
- Support informed decision-making

What Models Help Us Do

- Test management options
 - Evaluate harvest patterns and silviculture treatments
- Understand stand and landscape dynamics
 - Interactions among species, disturbances, environmental conditions
- Forecast growth, yield, and timber value
- Support assessments of carbon and habitat dynamics





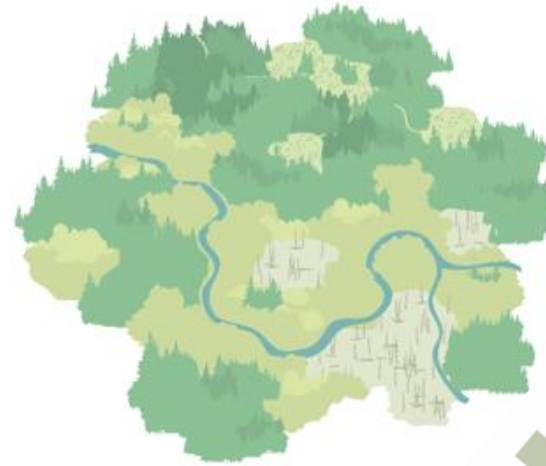
Stand-Scale Models

- Focus on individual stands
 - Simulate growth, competition and mortality dynamics
- May be individual-tree or whole-stand
- Useful for silviculture and stand-level decisions

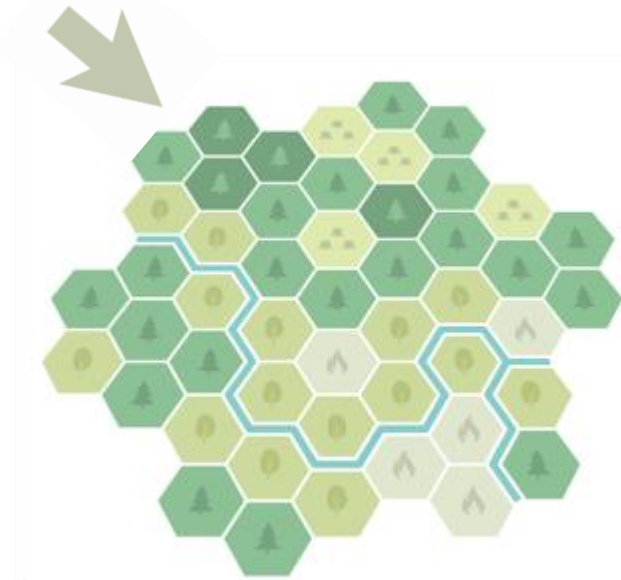


Landscape-Scale Models

- Cover large areas with many stands
- Include disturbance regimes, land-use changes, and long-term planning
- Examples: FSSIM, Patchworks, LANDIS-II
- Potential Applications:
 - How would fires and pest outbreaks influence future timber supply?
 - What are the effects of climate change on forests?
 - wildfire and forest health dynamics



Poll

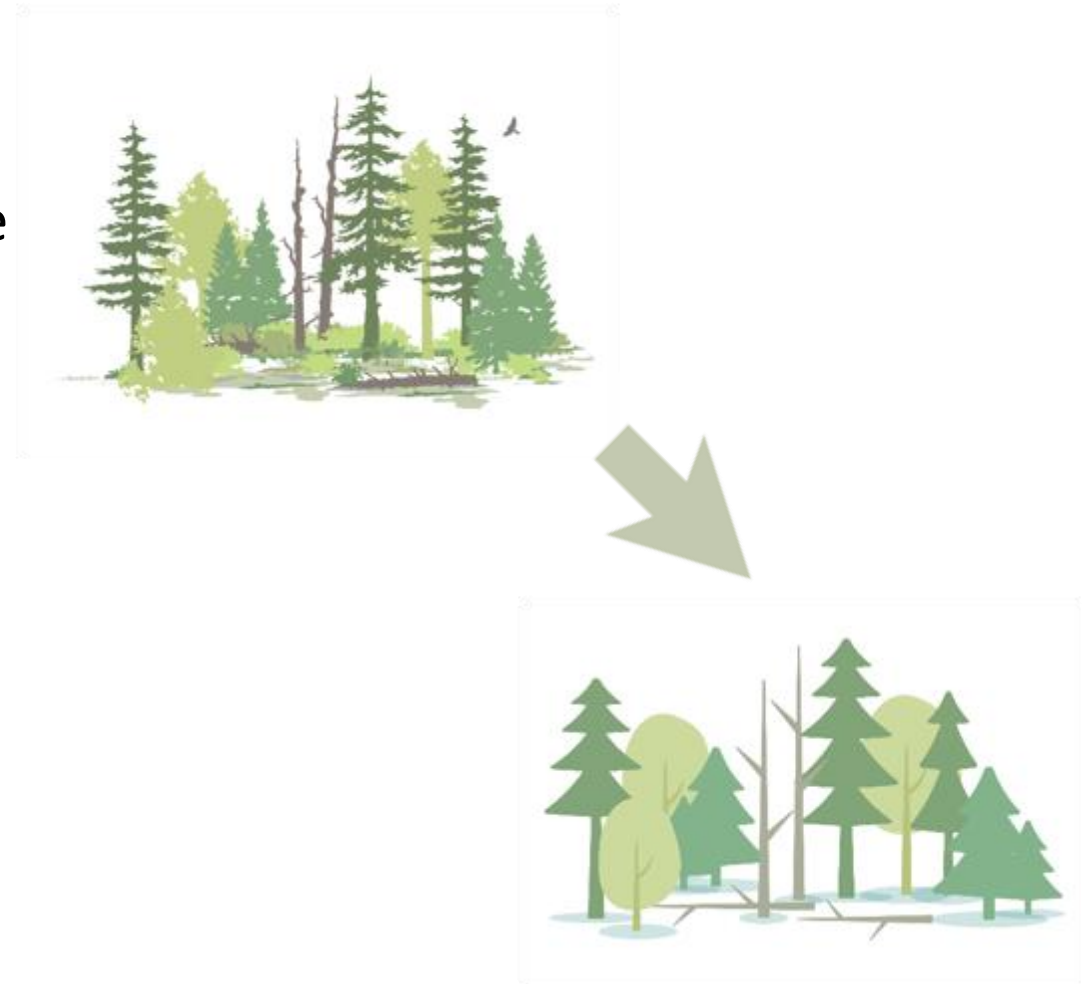


Limitations of Models

- Simplified representation of complex systems
- Quality of outputs reflect the quality and resolution of input data
- Need users familiar with the ecosystem and the model
 - Effectively interpret results
- Involve trade-offs between complexity and usability
- Require transparency in assumptions, data sources, and validation

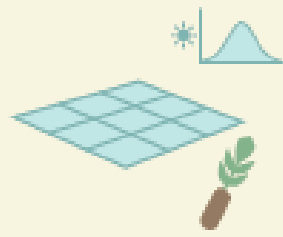
Stand-Scale Models

- Inputs:
 - Tree composition – species, size, density
 - Silviculture treatments and/or disturbance events
- Model ecological processes:
 - Rates of tree growth, tree mortality, competition between trees
- Outputs:
 - Stand growth over time
 - Change in species composition
 - Growth and yield tables



INPUTS

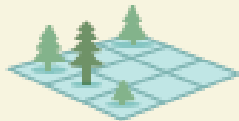
Initiate from bare ground:



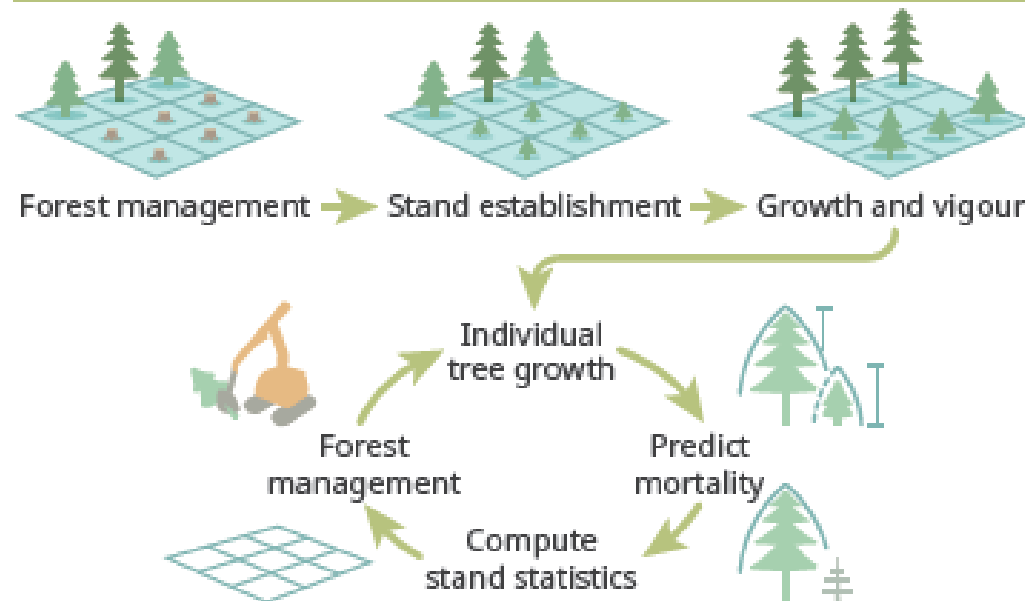
Site-level conditions
(e.g., site index, ingress)

Regeneration information
(e.g., species, density,
stand arrangement)

(Optional) initiate
from existing stand:



MODEL



EXAMPLE OUTPUTS

Growth and yield projections
including wood volume and
value, carbon sequestration
and biomass



Tree-level
outputs
(e.g., diameter
and height)



Stand-level
outputs
(e.g., total
wood volume)



Ministry of
Forests

Quiz Time!



TASS - Tree and Stand Simulator

- Regional Applicability: Forests of B.C.
 - Designed for *Fdc, Fdi, Cw, Hw, Ss, Dr, Sx, At, Pl* + additional sp.
- Function:
 - Provincially developed and supported model for growth and yield
 - Individual tree growth & yield model
 - Models thinning, partial harvests, wood quality, fertilization, forest health
 - TASS II: even-aged, single species
 - TASS III: pine/spruce mixedwoods, multi cohort
 - *Calibrated for *Fdc, Fdi, Cw, Hw, Ss, Dr, Sx, At, Pl, Pl/Sx*



Stand scale



Individual tree



Spatially explicit



Models from bare ground

Applies to: B.C. coastal + interior regions
(Designed for 10 species*, can broadly apply to another 14)





TIPSY

- Table Interpolation Program for Stand Yields

- Regional Applicability: Forests of B.C.
 - Designed for *Fdc*, *Fdi*, *Cw*, *Hw*, *Ss*, *Dr*, *Sx*, *At*, *Pl* + additional sp.
- Function:
 - Desktop tool using TASS yield tables
 - User friendly, widely used
 - Even-aged, single species stands
 - Supports comparisons of management strategies

Stand scale

-  Meta model
-  Spatially explicit
-  Models from bare ground

Applies to:
B.C. coastal + interior regions (10 species*)








VDYP - Variable Density Yield Prediction

- Regional Applicability: Forests of B.C.
- Function:
 - Used for inventory updates & timber supply
 - Best for unharvested, undisturbed stands
 - Whole-stand model
 - Short- to medium-term projections



Stand scale

-  Whole stand
-  Not spatially explicit
-  Does not model from bare ground

Applies to:
Unmanaged stands
province-wide





SORTIE-ND

- Regional Applicability: parts of SBS and ICH in central and northwest B.C.
 - 9 species: *Sx*, *Pl*, *Hw*, *Cw*, *Bl*, *Ba*, *At*, *Ep*, *Act*
- Function:
 - Individual tree model for complex stands
 - Well-suited for mixed species interactions & disturbances (natural and complex harvest systems)
 - Models inter-tree competition, light, and natural regeneration



Stand scale

-  Individual tree
-  Spatially explicit
-  Models from bare ground

Applies to: Parts of central interior B.C. and northwestern B.C. (9 species*)





MGM - Mixedwood Growth Model

- Regional Applicability: boreal forests in northeastern B.C.
 - In 2026 calibration will be complete for southern interior B.C.
 - 5 species: *Sw*, *At*, *Pl*, *Pj*, *Sb* (with more in 2026)
- Function:
 - Originated as an individual tree model for boreal forests
 - Handles mixed species and disturbances
 - thinning, understory protection, and some forest health agents
 - Includes climate sensitive growth
 - Currently being calibrated for forests in the southern interior of B.C.



Stand scale

-  Individual tree
-  Not spatially explicit
-  Limited modelling from bare ground

Applies to:
Boreal forests in northeastern B.C.*








FVS-BC - Forest Vegetation Simulator

- previously Prognosis-BC
- Regional Applicability: southern interior B.C.
 - 13 species: *Fd, Sx, Pl, Bl, Hw, Cw, Pw, Py, Lw, Bg, Ep, At, Act*
- Function:
 - Individual tree model with broad capabilities
 - Models insects, pathogens, fire, climate
 - Supports carbon accounting
 - Developed in the United States and widely used across N. America



Stand scale

-  Individual tree
-  Not spatially explicit
-  Models from bare ground with use of extension

Applies to: Parts of southern interior B.C. (13 species*)



Which models will work for you?

- What region? Tree species?
 - Single species or mixed-species stand
- Spatially explicit?
 - Silviculture scenarios where spatial pattern matters
 - Irregular gap cuts
 - Strip cuts oriented east to west vs. north to south
- Validated for the question/use scenario
- Capability:
 - Natural regeneration
 - Climate sensitivity
 - Evaluate carbon

Modeling capability	TASS	TIPSY	VDYP	SORTIE-ND	MGM	FVS-BC
Regional applicability						
BEC zones or regions	Across B.C.	Across B.C.	Across B.C.	ICHmc2 and some SBS subzones	Northeastern BC; southern interior in development	IDF, ICH, ESSF, MS, PP and their major subzones
Tree species	Fdc, Fdi, Cw, Hw, Ss, Dr, Sx, At, Pl, Pl/Sx	Fdc, Fdi, Cw, Hw, Ss, Dr, Sx, At, Pl ⁴	All	Sx, Pl, Hw, Cw, Bl, Ba, At, Ep, Act	Sw, At, Pl, Pj, Sb	Fdi, Lw, Bg, Hw, Cw, Pl, Pw, Bl, Ep, At, Act, Sx, Py
Individual tree model	yes	Individual, tree-based meta-model	-	Yes	yes	yes
Spatially explicit	yes	-	-	yes	-	-

Modeling capability	TASS	TIPSY	VDYP	SORTIE-ND	MGM	FVS-BC
Useful for...						
Bare ground initialization	yes	yes	-	yes	Limited	Limited
Long-term modelling	yes	yes	Limited ⁶	yes	Limited ⁷	Yes
Modelling complex stands						
Multiple species	PI/Sx only (TASS III)	-	Limited	yes	yes	yes
Multi-layer or multi-ages	TASS III only	-	Limited	yes	yes	yes
Complex horizontal arrangements	yes	Limited	-	yes	-	Limited
Broadleaf species and broadleaf/conifer mix	At and Dr, no mixtures	At and Dr, no mixtures	yes	yes	yes	Yes
Natural Regeneration	yes	-	-	yes	-	limited

Modeling capability	TASS	TIPSY	VDYP	SORTIE-ND	MGM	FVS-BC
Clearcut	yes	yes	-	yes	yes	yes
Silviculture treatments	yes	yes	-	yes	Uniformly distributed	Uniformly distributed
Partial harvest systems	yes	-	-	yes	Spatially uniform	Spatially uniform
Commercial thinning	yes	Pure coastal Fd and interior PI only	-	yes	yes	yes
Insect outbreaks	yes	yes	-	yes	MPB only	yes
Forest disease	yes	yes	-	yes	-	yes
Wildfire	-	Predicts attributes that can be used for predicting wildfire	-	-	-	Yes, but does not predict ignition
Outputs include						
Dead trees	yes	yes	-	yes	yes	yes
Timber supply analysis	yes (TIPSY recommended for speed and ease)	yes	yes, for unharvested forests	Can produce yield curves for complex harvests	yes, but limited calibration in BC	yes, but limited calibration and no recent work in B.C.
Carbon accounting	yes	yes	-	yes	Can be derived from biomass	yes
Climate sensitive?	In development	-	-	In development	Yes	yes



Scenario #1

- SBS near Prince George
- Objective: Managing for ungulate habitat
 - Desired future condition – a mixed spruce/aspen stand at year 80
 - Should I brush this stand?
 - How much aspen do I need to retain?
- What model would you use?
 - Region, species, spatially explicit?
 - MGM or SORTIE

Additional Scenarios

- Explore implications of size and pattern of gap cuts in a mixed ICH in NW BC
 - Will support cedar regeneration?
 - Spruce regeneration?
 - SORTIE-ND
- Commercial thinning in SBS pine stand?
 - TASS, MGM, SORTIE-ND
- Commercial thinning in the southern interior?
 - TASS, FVS-BC

Questions models could be used to address:

- Following application of wildfire resilience stocking standards – what future condition will result in 20, 40, 60 years?
 - will natural ingress occur?
- How do partial harvest patterns compare to clearcuts in sequestering carbon over an 80-year horizon?
- Single tree selection – How long until the stand returns to pre-harvest basal area?

Bringing It All Together

- Models are powerful tools
- No single model fits all situations
- Model choice depends on:
 - Stand type
 - Region and ecosystem
 - Management objectives
 - Data availability
 - Complexity required
- Models complement field data and monitoring

Closing

- 6 models are available
 - TASS, TIPSYP, VDYP, SORTIE-ND, MGM, FVS-BC
- Strengths and capabilities differ
 - important understand what a model is appropriate for
- Support move toward innovative silviculture and developing stand development pathways
- Report is coming soon
- Webinars will follow
- **Models - continually under development and being updated**
 - What format of report is most useful to you? (website, printable pdf, published hardcopy)
 - Talk to me and let me know!

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Questions and Discussion

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